

Before the  
POSTAL REGULATORY COMMISSION  
WASHINGTON, D.C. 20268-0001

Periodic Reporting  
(Proposal Four)

Docket No. RM2016-12

**PUBLIC REPRESENTATIVE COMMENTS**

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I. INTRODUCTION

The Postal Service's Petition, filed pursuant to 39 C.F.R. § 3050.11, requests a change in analytical principles concerning the Postal Service's periodic reports. The analytical principle in question concerns the "treatment of purchased highway transportation costs within the CRA Report."<sup>1</sup> This proposal, Proposal Four, seeks to improve the cost attribution methodology for purchased highway transportation costs.

Currently, purchased highway transportation costs are attributed through a two-step process: first, the Postal Service determines to what extent changes in vehicle capacity miles ("capacity") cause changes in costs, and then determines to what extent changes in mail capacity miles ("volume") cause changes in capacity. Petition at 1. These two relationships are expressed as variabilities, the percent change in one variable with respect to the percent change of another variable. The Postal Service uses the product of these variabilities to determine the volume variability of purchased highway transportation costs. This process is detailed in formula 1 below:

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<sup>1</sup> Docket No. RM2016-12, Petition of the United States Postal Service for the Initiation of A Proceeding to Consider Proposed Changes in Analytical Principles (Proposal Four), August 22, 2016.

*Formula 1*  
*Development of Highway Transportation Volume Variability*

$$\frac{\% \text{ Change in Cost}}{\% \text{ Change in Capacity}} \times \frac{\% \text{ Change in Capacity}}{\% \text{ Change in Volume}} = \frac{\% \text{ Change in Cost}}{\% \text{ Change in Volume}} = \text{Volume Variability of Highway Transportation Costs}$$

The capacity-to-volume variability is the subject of this docket.<sup>2</sup> Currently, this variability is assumed to be 100 percent, meaning that volume and capacity scale proportionately. The Commission, however, questioned that assumption and suggested the Postal Service to empirically test this assumption. Petition at 2. The proposal develops a model to estimate the variability of capacity with respect to volume, which estimates that variabilities by contract type are less than 100 percent. *Id.* It is based on an approach suggested by the Commission in Docket No. N2010-1, using more recent data, as well as crafting some modifications.<sup>3</sup> The Public Representative finds that, with some recommended modifications, the model successfully accomplishes an econometric regression of capacity against volume to estimate contract-type variabilities. However, it does not appear to incorporate operational conditions governing managerial transportation decisions and the contract terms which constrain short-run managerial decisions. Additionally, this model has some inconsistencies in form and data selection with the cost to capacity models, which may result in biased overall transportation variability estimates. Most problematic is when these variabilities are combined with the cost-to-capacity variabilities established in RM2016-4. In hindsight, the model used for cost-to-capacity estimation may possess endogenous variables, which may result in biased cost-to-capacity estimates, and therefore biased

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<sup>2</sup> The cost-to-vehicle capacity variability was the subject of Docket No. RM2014-6, which set the currently used variabilities for purchased highway transportation. Docket No. RM 2014-6, Order No. 2180, Order On Analytical Principles Used In Periodic Reporting (Proposals Three Through Eight) (Issued September 10, 2014) at 15.

<sup>3</sup> Docket No. N2010-1, PRC-N2010-1-LR5, PRC Analysis of Highway Transportation Cost Savings, March 24, 2011.

cost-to-volume estimates. The capacity variable in the cost-to-capacity model is endogenous because each observation of capacity is already partly determined by the effect changes in volume have on capacity. The bias in those estimates would be compounded were they to be multiplied by the proposed capacity to volume variabilities.

Consequently, the Public Representative believes that while the model generally captures the short-term variability of vehicle capacity to mail volume, it should not be used to multiply by the cost-to-capacity variability estimated in RM2014-6 in order to establish overall transportation variabilities. The Public Representative is not convinced the proposed model is appropriate to estimate long-term variabilities, which is the Commission's goal for variability studies.<sup>4</sup>

The Public Representative recommends the Commission reject the proposed model and open an inquiry into the appropriate data, operational factors, and types of models which would produce unbiased long term variability estimates of overall transportation variability. The Public Representative found several errors with the proposed model itself and provided the results from correcting those errors. However, it believes that neither the proposed model, nor the model made with its corrections should be used to multiply against the cost to capacity variabilities from the RM-2014-6 Transportation Study to establish overall transportation variabilities.

## II. BACKGROUND

### A. The Commission's Exploratory Model from Docket No. N2010-1

In Docket No. N2010-1, the Commission developed an exploratory Model ("PRC Exploratory Model") to determine contract level (Intra-SCF, Inter-SCF, Intra-NDC, and Inter-NDC) capacity-to-volume variabilities in order to estimate the cost savings from reducing deliveries from six days to five days.<sup>5</sup> This model assumed that changes in the

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<sup>4</sup> See, e.g., "We also adhere to our view expressed in Docket No. R77-1 that the relative magnitude of unforeseen events, including external events, over the long run will tend to display a degree of predictability, based upon historical results." PRC Op. Rec. R87-1, para. 2077 (Citations omitted.)," Docket No R2000-1, Op. Rec., Revised Volume 1, at 67, fn. 20.

<sup>5</sup> See, Docket No. N2010-1, PRC-N2010-1-LR-5 - *PRC Analysis of Highway Transportation Cost Savings*, *PRC Transportation Appendix*, March 24, 2011 ("PRC Exploratory Report").

cubic feet of transported mail cause cubic foot miles to vary through changes in the number of trips.<sup>6</sup> The Commission aggregated Transportation Cost System (“TRACS”) data by day of week, postal quarter, fiscal year, and contract type. The Commission tested a log-log model of this relationship between trips and cubic mail volume (hereafter called “mail volume”) using TRACS data. PRC-N2010-1-LR-5 at 7. This model contained dummy variables for fiscal years, and its log-log functional form allowed the coefficients to be directly interpreted as variabilities. The results for each contract type were statistically significant. *Id.* at 8. Three of the variabilities were less than 100 percent, but the intra-SCF variability, was over 100 percent, which the Commission attributed to “the acute service-related constraints that might be expected on intra-SCF transportation runs.”<sup>7</sup> The Commission adjusted the weekday cost savings estimates based on these variabilities. *PRC Exploratory Report* at 1.

B. Cost to Capacity Variability in Docket No. RM2014-6

The Commission accepted the Postal Service’s model to update the cost to vehicle capacity variabilities it proposed in RM2014-6 (Proposal Six). *Docket No. RM2014-6, Order On Analytical Principles Used In Periodic Reporting (Proposals Three Through Eight) (Issued September 10, 2014), Order No. 2180*. The Postal Service utilized route-type data from the fourth quarter of FY 2013 contained in the Transportation Contract Support System (TCSS) to estimate variabilities for 16 different contract/route-types (“route-types”).<sup>8</sup> In order to estimate this many types of variabilities, it relied upon data aggregated only from trip/day level to the route-type level.<sup>9</sup>

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<sup>6</sup> *Id.* at 7.

<sup>7</sup> Advisory Opinion at 99.

<sup>8</sup> Variabilities were estimated for the following contract/route-types: Intra-P&DC/(Box, City, Van, Tractor Trailer), Intra-District/(Box, City, Van, Tractor Trailer), Inter-P&DC/(Van, Tractor Trailer), Inter-Cluster/(Van, Tractor Trailer), Inter-Area/(Van Tractor Trailer), Intra-NDC/Tractor Trailer, Inter-NDC/Tractor Trailer, and Plant Load/Tractor Trailer. See, *USPS-RM2014-6/1, Report on Updating the Cost-to-Capacity Variabilities for Purchased Highway Transportation* (“2014 Purchased Highway Report”), by Michael D. Bradley, submitted June 20, 2014, at 11. Fifteen of these 16 variabilities were aggregated to 7 variabilities using cost weights (Intra-P&DC, Intra-District, Inter-SCF, Inter-P&DC, Inter-Cluster, Inter-Area, Intra-NDC, and Inter-NDC. Plant Load Variability, the only one over 100 percent was not included. See, *USPS-RM2016-12, Proposal 4, Research on Estimating the Variability of Purchased Highway*

### C. The Postal Service's Proposed Model

In this proceeding, the Postal Service, as reported by Dr. Michael Bradley, uses the *PRC Exploratory Model* from Docket No. N2010-1 as the baseline for its model of the variability of vehicle capacity to mail volume. Bradley uses the same data source (TRACS) as the Commission's Exploratory Model. He refreshes the data for this model with TRACS data from FY 2011 through 2015, and aggregates it by contract type, day of week, postal quarter, and fiscal year.<sup>10</sup> Bradley Report at 16. This produces a data set of 28 observations per quarter (7 days over four weeks), 112 observations per year, and 560 observations over 5 years.<sup>11</sup> Bradley first adds an additional variable to the model for Intra-SCF contracts in order to control for the unique nature of Sunday Intra-SCF observations.<sup>12</sup> This was done to address the PRC Exploratory Model's unexpected estimate of 109 percent Intra-SCF variability. *Id.* at 11.

He also includes two additional variables: a second order log term for volume to allow for a non-linear relationship between volume and capacity, and a discrete day of week variable to control for possible effects of weekly volume patterns. *Id.* at 16. He estimates four variabilities, one for each contract of four types of transportation contracts in the TRACS database: Intra-SCF, Inter-SCF, Intra-NDC, and Inter-NDC. The variabilities estimated by this model are statistically significant and less than 100 percent. *Id.* at 17.

Bradley also makes another change in the model he does not describe in his report. In finalizing the aggregated data used in the regression, he centers each

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*Transportation Capacity with Respect to Volume* ("2016 Highway Capacity Report"), submitted August 22, 2016, Table 15 at 34.

<sup>9</sup> A contract might include trips which used vans, tractor trailers, or were city or box routes, each of which would be a type of cost segment, with its own variability.

<sup>10</sup> Postal Quarter 1 is the same as Calendar Quarter 4. So a Postal Year is equivalent to a Fiscal Year.

<sup>11</sup> Although FY2010 was included in the original dataset, it was not included in the proposed analysis because it was possible highway transportation route structure that year was qualitatively different than subsequent fiscal years. See, *Id.* 29.

<sup>12</sup> *Id.* 12-13.

observation of mail volume on its mean value for each observation's contract type.<sup>13</sup> Mean centering data in a translog model allows the coefficient of the first-order term in a translog function to equal to elasticity. See, *2016 Highway Capacity Report*, at 11.

Bradley also removes observations with zero reported mail volume. He notes that a "material proportion of TRACS tests...include the cubic capacity and number of trips for the route on which the test was taken, but no volume." *Id.* at 18. As a result, if these zero-volume observations were included in the aggregation, there would be a "mismatch... in the relation of cubic truck miles [where all observations at the trip-level are positive] and cubic mail capacity [where a substantial number of observations at the trip level are zero]." *Id.* At the aggregated level the regression is performed the zero volume mail observations do not explicitly appear, since they are combined with other trips which do contain positive mail volume. Bradley expresses concern that this mismatch could understate the true relationship between trips and volume and by extension the variabilities between capacity and volume, and therefore removes the trip-level observations of vehicle capacity which do not have corresponding mail volume. *Id.* at 19

The *PRC Exploratory Model* for capacity to volume variability used the log of trips as its dependent variable, which Bradley notes requires assuming that "neither cubic capacity nor route miles change when volume changes." *Id.* at 20. He therefore proposes a broader measure of capacity: moving capacity, which is equal to annual vehicle capacity multiplied by annual trips ("capacity"). This measure of capacity allows it to change when annual volume ("volume") changes.<sup>14</sup> He uses the log of volume as his dependent variable for measuring the relationship, specifically, the elasticity or variability, between vehicle and volume. *Id.* at 21.

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<sup>13</sup> This is represented in the SAS code as "mcvol=SVol/GMVol"

<sup>14</sup> Transported Mail Capacity is defined as the product of annual cubic mail capacity and annual trips.

Bradley makes one final adjustment to the *PRC Exploratory Model*: he adjusts for autocorrelation. Durbin-Watson tests report autocorrelation for certain contract types, for which he corrects in an appropriate manner. *2016 Highway Capacity Report* at 23-28.

The final model specification proposed by the Postal Service for each contract type is formula 2, below<sup>15</sup>:

*Formula 2*  
*USPS's Proposed Model Specification for a Given Contract Type*

$$\ln(\text{capacity}) = \alpha + \beta_1 \ln(\text{Volume}) + \beta_2 \ln(\text{Volume}^2) + \beta_3 \text{Day of Week} + \varepsilon$$

Based on this model, the Postal Service proposes the following variabilities for each of the four contract types of purchased highway transportation. *Id.* at 4:

*Table 1*  
*USPS' Proposed Variabilities*

<b>Contract Type</b>	<b>Proposed Variability</b>
Intra-SCF	77.27%
Inter-SCF	82.13%
Intra-NDC	78.77%
Inter-NDC	84.82%

These four capacity-to-volume variabilities are then multiplied by the mail capacity-to-cost variabilities estimated in RM2014-6 by treating “the two categories that make up Intra-SCF transportation, (Intra-P&DC and Intra-District) and the three categories that make up Inter-SCF transportation (Inter-P&DC, Inter-Cluster, and Inter-Area) as having the same capacity-to-volume variability.” *Id.* at 34.

Bradley notes that these variabilities will reduce the amount of purchased highway transportation costs attributed to products. *Id.* at 5. It reports the changes in

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<sup>15</sup> The Intra-SCF model, as stated above, includes a dummy variable for Sunday observations, which has been omitted for simplicity.

transportation costs and unit costs on pages 6 and 7 of the petition, with the largest impact on Package Services and Competitive Mail.

### III. COMMENTS

#### A. Introduction

Assuming the relation between the cost to capacity and vehicle to mail capacity are correct, there are no significant problems with using regressions estimated at different aggregation levels, and some form of the translog functional form is correct, the Public Representative makes some modest modifications to improve the soundness the proposed model. However, the Public Representative maintains that the Commission should not accept the proposed model because:

- the cubic vehicle capacity variability is endogenous, so it is not appropriate to separately estimate a cost to vehicle capacity variability, and a vehicle to mail capacity variability.
- the differences in data selection, aggregation, and variable definitions between the cost to vehicle capacity and capacity to mail volume variability estimates create inconsistent and possibly biased estimates of overall transportation variability,
- the specification of the vehicle to mail capacity variability is not structurally consistent with the cost to vehicle capacity variability, and
- the proposed model does not capture key aspects of the contracting process.

#### B. Assuming The Basic Functional Form Of The Proposed Model Assuming Is Correct, The Public Representative Suggests Several Modifications.

The Public Representative identifies three issues with data selection and model specification, and recommends three changes to address them. The issues are the removal of observations with zero volume, the misclassification of the day-of-week variable, and the lack of certain additional dummy variables. While the Public Representative recommends adopting all three proposed changes, each change may be implemented independently. The model specification the Public Representative

proposes in this case is formula 3, below. The next three sections detail the deviations from the Postal Service's proposed specification, as well as the variabilities and financial impact of the Public Representative's proposed specification.

*Formula 3*  
*The Public Representative's Proposed*  
*Model Specification for a Given Contract Type*<sup>16</sup>

$$\ln(\text{Capacity}) = \alpha + \beta_1 \ln(\text{Volume}) + \beta_2 \ln(\text{Volume}^2) + \beta_{3...7} \text{Day of Week Dummies} \\ + \beta_{8...11} \text{Postal Quarter Dummies} + \beta_{12...15} \text{Fiscal Year Dummies} + \varepsilon$$

1. Observations with Zero Mail Volume Should Not Be Removed

In modifying the Commission's Exploratory Model, Bradley removes observations with zero mail volume, stating that retaining them could "cause the data to understate the true relationship between the number of trips and volume and ... cause the estimated equations to understate the variabilities." Bradley Report at 18. The Public Representative disagrees with this decision, and believes that the zero mail volume observations are no more a mismatch than observations with nonzero mail volume.

The Public Representative has two objections to removing these observations: first, the sheer number of observations removed (18 percent) diminishes the accuracy of the model, and second, Bradley's mismatch argument concerning these observations applies equally to observations with nonzero mail volume.

The Public Representative examined the deleted zero mail volume observations and found that every observation with zero mail volume was coupled with positive vehicle capacity, suggesting these trip-level observations may be due to the practice of "dead-heading," where a vehicle returns from a trip without mail, and as part of the normal sampling process, where a random sample observation will occur at stops which have fully unloaded their mail and have zero volume.

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<sup>16</sup> This specification also obviates the need for a Sunday observation dummy in the Intra-SCF model. Additionally, where joint significance tests demonstrated a statistically insignificant set of dummy variables for a contract type, the model was re-estimated without that set of dummies.

It is also possible that a large amount of the “dead-heading” results from an exogenous circumstance: the Universal Service Obligation, which requires the Postal Service to deliver mail to every corner of the United States, regardless of the density of any given corner. As a result, many trucks may go unused or underused on many days, explaining excess capacity.

The TRACS data from which Bradley develops his variabilities has 56,369 observations. From this number, he removes the FY 2010 observations, reducing the number of FY 2011 to FY 2015 observations to 47,333. Further removing the zero mail volume observations reduces the total number of observations to 38,658, dropping nearly 20,000 observations overall. In sum, there are 8,675 zero mail volume observations from FY 2011 through FY 2015. Bradley is, in effect, dropping 18 percent of his FY 2011 through FY 2015 observations.<sup>17</sup> Good statistical practice would suggest not removing so many or such a large proportion of observations without an extremely compelling argument.

Bradley argues that retaining these observations could understate the vehicle capacity-to- mail volume variability because these observations “include the cubic capacity and number of trips for the route on which the test was taken, but no volume.” *Id.* It is significant that these observations include the number of trips. Because the dependent variable is *moving* capacity, that is, truck capacity multiplied by annual trips, a zero-volume observation suggests that the truck being sampled has no volume over an entire quarter during a year, because this single observation is being extrapolated to represent the entire quarter for that route.<sup>18</sup> The sampling methodology is implemented such that the mail volume in that one observation is representative of mail volume over the entire year. It is naturally possible that the sampled observation is not representative of the mail volume for the entire year, but that argument applies as easily to

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<sup>17</sup>  $\frac{8675}{47333} = 18\%$

<sup>18</sup> For consistency, the volume independent variable is also multiplied by the number of annual trips. Response to CHIR No. 1, Question 9.

observations (trucks) with nonzero volumes. It is just as possible, however, to conceptualize a truck having nonzero mail volume on the day it was sampled and zero mail volume on many non-sampled days.<sup>19</sup> While these extrapolations could be problematic for the representativeness of the TRACS data, the large number of observations mitigates that concern. Through the Central Limit Theorem, the large number of samples across all the different trucks will create a normal distribution of volumes and capacities, allowing for accurate statistical analysis. This is only possible, however, when not removing specific types of observations. As a result, the Public Representative recommends retaining the zero-volume observations.

## 2. Day-of-Week Dummy Variable Is Not Specified Correctly

The model specification Bradley proposes contains a day-of-week (DOW) variable to control for possible weekly fluctuations in volume. Including such a variable makes sense, particularly to avoid omitted variable bias, where an omitted variable affects the coefficient of another variable, which would, in this case, lower the accuracy of the variabilities.

The DOW variable, however, is structured as a discrete variable, with values ranging from 1 to 7, where 1 represents Sunday.<sup>20</sup> Structuring a control variable for DOW fluctuations as a discrete variable is an uncommon and problematic way to structure the variable. A discrete, or continuous, independent variable assumes a consistent relationship between the values of a variable. This is particularly important when interpreting the coefficients of a variable, as a one unit increase in the independent variable represents an increase in the dependent variable by the coefficient. If the values in the independent variable do not represent a linear relationship, such an interpretation is impossible. Using a discrete DOW variable is only

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<sup>19</sup> It is also probable that had the same vehicle been sampled at a different stop, positive mail volume would have been observed.

<sup>20</sup> Responses of the United States Postal Service to Questions 1 - 9 Of Chairman's Information Request No. 1, Response to Question 2.

reasonable if mail capacity increases or decreases consistently from Sunday to Saturday.

To avoid this concern, the Public Representative recommends developing the DOW variable into a series of dummy variables, one for each day of week. The Postal Service states that it chose a discrete variable to “reduce the likelihood of creating a singular or near-singular matrix.” While a notable concern, the Public Representative’s statistical analysis demonstrates that no singular matrix occurs when splitting the DOW variable into a series of dummy variables. Such a split is further justified by the statistical significance of these dummy variables.

### 3. Fiscal Year and Postal Quarter Dummy Variables Should Be Included

The model specification Bradley proposes to estimate capacity-to-volume variabilities contains no dummy variables to control for unique fiscal year or seasonal effects. This is particularly notable, as the original analysis contained dummy variables for the fiscal years, many of which are statistically significant at the 5 percent level. The Public Representative, therefore, proposes the following sets of dummy variables:

- Fiscal Year (FY): a set of dummy variables for each fiscal year (e.g. D2011, which equals 1 in the year 2011 and 0 otherwise),<sup>21</sup>
- Postal Quarter (PQ): a set of dummy variables for each postal quarter (e.g. Q1, which equals 1 in postal quarter 1 (October-December) and 0 otherwise).

These dummy variables are important to include in the model specification because they can control for effects unique to a postal quarter or fiscal year. As an example, the first postal quarter generally has the largest mail volume, being the holiday season, and therefore trucks are likely to use additional capacity. Not controlling for this effect could result in omitted variable bias. Many of these dummy variables are statistically significant in estimating the capacity-to-volume variability. Including these additional variables does not significantly reduce the degrees of freedom in the

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<sup>21</sup> Bradley initially included a dummy for FY 2010 in his specification, but removed it when he removed observations from FY 2010.

regression, nor does it significantly affect the variabilities, but has the benefit of increasing the Adjusted  $R^2$  term of the regression.<sup>22</sup>

#### 4. These Improvements Affect Unit Costs

The Public Representative's proposed variabilities and  $R^2$  terms are included in table 2, below<sup>23</sup>:

*Table 2*  
*USPS Variabilities and  $R^2$  terms compared to PR's Proposed Variabilities<sup>24</sup>*

<b>Contract Type</b>	<b>USPS Variability</b>	<b>USPS <math>R^2</math></b>	<b>PR Variability</b>	<b>PR <math>R^2</math></b>
Intra-SCF	77.27%	97.17%	61.03%	96.71%
Inter-SCF	82.13%	94.23%	53.82%	93.00%
Intra-NDC	78.77%	89.50%	62.49%	92.47%
Inter-NDC	84.82%	92.79%	76.36%	91.90%

Including zero-volume observations, and including dummy variables results in a minor decrease in the Adjusted  $R^2$  terms and a decrease in the variabilities for each contract type. Notably, none of the regressions test positive for autocorrelation, and therefore require no correcting lags. Furthermore, a cross-validation test<sup>25</sup> demonstrates very similar variabilities, demonstrating the robustness of this model. The Inter-SCF variabilities do decrease more than the other contract types, both compared to the Postal Service's variability estimates and in the cross-validation test which causes the dummy variables to be more influential. Operationally, it could reflect the daily variations in volume necessary for meeting service standards.

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<sup>22</sup> Adjusted  $R^2$  penalizes the goodness of model fit with an increase in variables. So, if adding dummy variables increases the Adjusted  $R^2$ , they overcome the penalty and improve model fit. Though not reported here, the adjusted  $R^2$  terms closely match the reported terms.

<sup>23</sup> The SAS Code used to develop these variabilities and the Output files are included in PR-RM2016-12-LR-1. This code also specifies which sets of dummy variables are used in each contract type.

<sup>24</sup> PQ 1, FY 2015, and Sunday are the omitted dummy variables to avoid multicollinearity. As stated above, these are the variabilities after re-estimation to remove sets of jointly insignificant dummy variables.

<sup>25</sup> A cross-validation test is an econometric test where a percentage of the observations (70 percent in this test) are used to estimate the equation. The equation is then used to predict the remaining percent (30 percent in this test) of the observations.

While these variabilities do reduce the amount of costs attributable to products below the Postal Service's proposal, the Public Representative believes that they are a more accurate representation of the capacity-to-volume variability, particularly given the Universal Service Obligation and peak load conditions. Additionally, as a House of Representatives Committee Report has noted, it is more important for cost attribution to be accurate than to aim for maximal attribution.<sup>26</sup>

. The overall variability, therefore, is in table 3, below:

*Table 3*  
*USPS Overall Variabilities compared to PR's Proposed Variabilities<sup>27</sup>*

<b>Transportation Category</b>	<b>USPS Overall Variability</b>	<b>PR Overall Variability</b>
Intra-SCF	49.7%	39.2%
Intra-P&DC	58.5%	46.2%
Intra-District	29.4%	23.2%
Inter-SCF	73.2%	48.0%
Inter-P&DC	69.8%	45.7%
Inter-Cluster	73.2%	48.0%
Inter-Area	73.8%	48.4%
Intra-NDC	74.7%	59.3%
Inter-NDC	80.3%	72.3%

This table demonstrates that the largest changes in overall variabilities come in categories that utilize the SCF variabilities. Table 4 below, reports overall impact on unit cost. Generally, the impact of the Public Representative's variabilities nearly doubles the percentage change in unit costs at the product and class level (Alaska Bypass being a major exception).

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<sup>26</sup> Postal Accountability and Enhancement Act, Committee on Government Reform, H.R. Rep. No. 109-66, pt. 1, at 49 (April 28, 2005)

<sup>27</sup> These are the capacity-to-volume variabilities multiplied by their respective cost-to-capacity variabilities, as reported by Bradley at 34. This table, however, appeared to exclude the overall Intra-SCF variability. The Public Representative has included it here based on the Postal Service's workpapers.

*Table 4*  
*USPS and PR Impacts on Unit Attributable Cost<sup>28</sup>*

	USPS % Change in Unit Attrib. Cost	PR % Change in Unit Attrib. Cost
<b>FIRST-CLASS</b>		
Single-Piece Letters	-0.8%	-1.6%
Single-Piece Cards	-0.3%	-0.7%
Presort Letters	-0.8%	-1.8%
Presort Cards	-0.9%	-1.7%
Flats	-1.7%	-3.5%
Parcels	-1.8%	-3.7%
<b>TOTAL DOMESTIC FIRST-CLASS</b>	<b>-0.9%</b>	<b>-1.9%</b>
<b>STANDARD MAIL</b>		
High Density And Saturation Letters	-0.3%	-0.5%
HD & Saturation Flats & Parcels	-0.4%	-0.7%
Carrier Route	-0.6%	-1.1%
Letters	-0.6%	-1.2%
Flats	-1.2%	-2.1%
Parcels	-1.6%	-3.0%
Every Door Direct Mail - Retail	0.0%	0.0%
<b>TOTAL STANDARD MAIL</b>	<b>-0.7%</b>	<b>-1.3%</b>
<b>PERIODICALS</b>		
In County	0.0%	0.0%
Outside County	-1.9%	-3.7%
<b>TOTAL PERIODICALS</b>	<b>-1.8%</b>	<b>-3.5%</b>
<b>Package Services</b>		
Alaska Bypass	-17.2%	-44.3%
Bound Printed Matter Flats	-3.0%	-5.7%
Bound Printed Matter Parcels	-1.8%	-3.3%
Media And Library Mail	-4.6%	-8.4%
<b>TOTAL PACKAGE SERVICES</b>	<b>-3.7%</b>	<b>-7.2%</b>
<b>TOTAL DOMESTIC COMPETITIVE</b>	<b>-2.5%</b>	<b>-5.0%</b>

<sup>28</sup> The spreadsheets used to develop this table are included in PR-RM2016-12-LR-1.

C. The Commission Should Open an Inquiry to Closely Examine the Feasibility of Developing A Database Able To Provide Structurally Consistent And Econometrically Sound Estimates Of Overall Transportation Variability

By itself, the proposed model succeeds at estimating the capacity-to-volume variability. However, when combined with the cost-to-capacity variabilities, the Public Representative identifies four problems, which make the proposed model an inappropriate vehicle to modify the existing transportation variability estimates. The problems are:

- biased overall transportation variabilities due to data structure differences between the TCSS and TRACS,
- inconsistencies due to different definitions and collection protocols associated with regression variables obtained from TRACS and the TCSS which may produce biased variability estimates,
- potentially inconsistent and biased estimates of the 16 cost-to-capacity variabilities due to the endogeneity of the independent variable “capacity” in the cost to capacity model, and
- omitted variable bias from omitting variables which capture key aspects of contracting practice from the cost-to-capacity variability models.

1. Sample Structure And Modeling Differences Between the TCSS and TRACS May Bias Overall Transportation Variability

Overall transportation variability is the product of 9 cost-to-capacity variability estimates utilizing data from the TCSS, and 4 capacity to volume variability estimates using TRACS data.<sup>29</sup> The cost to capacity variability estimates were obtained using data from the TCSS, which “is used to manage highway transportation requirements for contracts and payment processes.” 2014 Transportation Study at 6. The TCSS is a

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<sup>29</sup> The 2014 Transportation Study estimated 16 variabilities, including one for Plant-Load route-type. All but the Plant-Load variability were transformed into the 8 variabilities listed in Table 15 of the 2016 Transportation Study by taking the cost-weighted average of the relevant route-level variabilities for each of the 8 variabilities.

national database, which contains data at a lower level of aggregation than the highway contract level.<sup>30</sup> This allowed route-type (Box, Van, and Tractor Trailer) for each type of contract (intra-SCF, inter-SCF, intra-NDC, inter-NDC, and Plant Load) to be the unit of analysis.<sup>31</sup> The 2014 Transportation Study updated the cost to capacity variabilities using data from the fourth quarter of FY2013.

The data used by the proposed capacity-to volume models were drawn from five years of TRACS data. TRACS is an extremely disaggregated database, having, route, trip, stop, and day data for each of 4 contract types (intra-SCF, inter-SCF, intra-NDC, and inter-NDC), with over tens of thousands of observations per quarter.<sup>32</sup> However, in contrast to the level of aggregation available at the TRACS sampling unit, Bradley's regressions utilized data at a much higher level of aggregation. He summed relevant model variables from below the route level up to a single observation for each day of the week, by quarter, by contract-type, for each of 5 sample years. At this level of aggregation, he was able to perform a regression for each of the previously identified contract types using 140 observations per regression. The regressions did not contain a variable for route-type, which might have allowed the vehicle to mail capacity variability estimates to more closely match the number of cost-to-capacity estimates approved in RM2016-4. Moreover, the routes used for each regression differed by quarter and year,

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<sup>30</sup> It appears data is recorded by route, yielding nearly 99,000 observations. Many routes are recorded multiple times at different portions of a number of trips which may occur on the route. Splitting accounts into 16 different types of routes, and summing values to a single route type for each contract type, yields nearly 30,000 observations of cost and vehicle capacity.

<sup>31</sup> The Transportation Report says that the dataset was an extract taken at a specific moment in time....The Report at 6, states that "[t]he dataset for this econometric analysis was drawn in the fourth quarter of FY2013." Since the TCSS changes daily, it is possible that the extract was drawn from a single day in the fourth quarter of FY2013. In that case it would contain a day of data, but not daily data. However, even if data were drawn from a single day, not all contracts would have reflected a recently negotiated contract, only some percentage. As will be discussed later, the apparent "stickiness" of contracting for capacity, suggests that changes may be needed in the cost-to-capacity model.

<sup>32</sup> Two of the primary files used to produce the transportation distribution keys for highway transportation have tens of thousands of observations each year, thousands of which can be aggregated into variables which possibly could be used to estimate improved highway regression analyses. Model specification will be discussed in more detail in another section.

making it impossible to track the relation between vehicle and mail capacity by route over time.<sup>33</sup>

Because the data structures and number of observations substantially differ for both studies and for most regressions, the product of the two types of variabilities is likely to produce biased estimates of overall transportation variability by contract type. Specifically, in order to take the product of the cost to capacity and the capacity to volume variabilities, it was necessary to duplicate several *contract-level* capacity to volume variabilities from the proposed study, in order match the 9 *route-level* cost to capacity variabilities. Thus, the capacity to volume capacity variability for inter-SCF contract types was applied to 4 different route-type variabilities of cost to capacity, and the capacity to volume variability for Intra-SCF contract types was applied to two different route-type variabilities. Where the single intra-SCF route-type variability was applied to two different route-type variabilities, one route-type variability is nearly twice as large as the other, even though same contract-type variability is applied to both. Although, the mismatch is smaller with regard to the application of the inter-SCF contract-type variability to 4 route-type variabilities, the overall transportation variabilities may, nevertheless, be biased for these two types of contracts.<sup>34</sup>

## 2. TCSS and TRACS Data Use Different Collection Methods To Define Vehicle Capacity Which Introduces Biased Estimates of Overall Transportation Variability

The Postal Service describes the TCSS as a tool to manage transportation requirements through the contracting process.<sup>35</sup> Each contract specifies the type of vehicle (with known volume) and the number of trips and stops per trip. The TCSS also

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<sup>33</sup> The dataset is pooled time series and cross section data, but is not panel data.

<sup>34</sup> The Public Representative used data the from TCSS from FY2013 which the Postal Service provided as public data in RM2014-6). He calculated that inter-SCF contracts accounted for approximately 55 percent of the transportation contract costs negotiated, and inter-SCF accounts for approximately 27 percent highway transportation contracts. A total of 83 percent of the largest contracts involve contract types with cost to vehicle capacity variabilities which do not properly match vehicle to mail capacity variabilities.

<sup>35</sup> See, Transportation Contract Support System (TCSS), viewed at [http://about.usps.com/suppliers/competitionreport2012/CompRprt\\_fy12\\_007.htm](http://about.usps.com/suppliers/competitionreport2012/CompRprt_fy12_007.htm), on October 13, 2016.

records the miles per route.<sup>36</sup> The Postal Service also explained that contracts allow actual vehicle capacity to increase if an increase in mail volume requires more frequent trips between already established locations.<sup>37</sup> The Public Representative does not know whether these extra trips are recorded in the TCSS. If not, then cubic vehicle capacity miles are known ahead of time, and are simply the known volume of a vehicle multiplied by the number of trip-miles. The Public Representative surmises that the TCSS does record the number of trips and trip segments transported by each vehicle during the year, and can provide the annual cubic foot miles actually travelled.<sup>38</sup> This would allow one to multiply cubic vehicle volume by actual trip-miles to obtain cubic foot miles of vehicle capacity. This was the independent variable used to estimate the cost to capacity variability for non-box routes in Bradley's 2014 Transportation Study.

In contrast, TRACS is an annual probability sample. It samples mail capacity utilization at the sample location, which is defined as a route-trip-stop-day combination.<sup>39</sup> TRACS does not obtain vehicle capacity from another source. It directly computes vehicle capacity at the moment a data collector, who is located at a pre-arranged stop and truck, measures the volume of unloaded mail, the volume of mail that remains on the truck, the volume of empty space, which is then added together when TRACS is produced.<sup>40</sup> Bradley's dataset uses vehicle space times trips as the dependent variable.

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<sup>36</sup> See, USPS-RM2014-6/1 - Public Material Relating to Proposal Six, File: tcss\_fy13.sas7bdat records trip-miles per route.

<sup>37</sup> Response Of The United States Postal Service To Chairman's Information Request No. 3, Response to Question 3,a,l, submitted October 5, 2016.

<sup>38</sup> The reason is because data from the TCSS are used to negotiate contract needs for each contract which expires. It would be difficult to do so without knowing the actual, not simply the contracted, cubic foot miles for each vehicle. Interestingly, the Postal Service's answer suggests that contract terms prevent it from reducing the frequency of trips below some negotiated level.

<sup>39</sup> Docket No. ACR FY2015, USPS-FY15-NP24, Transportation Cost System (TRACS) Documentation. Thus, cubic vehicle capacity is truck capacity multiplied by trips. See also, Responses Of The United States Postal Service To Questions 1-9 Of Chairman's Information Request No. 1 (September 13, 2016), Response to Question 9.

<sup>40</sup> Responses Of The United States Postal Service To Questions 1-10 Of Chairman's Information Request No. 2 (September 30, 2016), Response to Question 5.

The different methods of measuring vehicle space may differ between TCSS and TRACS. Although the Public Representative is not certain whether TCSS data on trip-miles is collected from daily records, or is directly taken from contract information, TCSS does not appear to directly measure vehicle capacity because it is specified in each contract for each vehicle, and may therefore not include additional trips made for excess volume. In contrast, vehicle capacity in TRACS is built up from a number of measurements taken at each sample route day, stop, per sampled truck. It goes without saying that vehicle capacity taken through thousands of sampled measurements are not likely to be done in exactly the same manner, which may introduce non-sampling bias into the capacity variable, in contrast to the value of capacity drawn from the TCSS. Although TRACS has a good reputation as a reliable sample, the non-sampling bias introduced into the measurement of vehicle capacity will create some amount of a mismatch between its measurement in TRACS and TCSS. This in turn will reduce the reliability of the estimate of the overall variability transportation cost to volume, which involves multiplying two sets of variabilities, each of which relies upon vehicle capacity to estimate each type of transportation variability.

3. Fourteen of the route-level variabilities in the 2014 Transportation Study rely upon the endogenous independent variable, capacity, which may result in inconsistent and biased variability estimates.

The basic form of these 14 cost to capacity models in the 2014 Transportation Study is expressed in Formula 4 below:

*Formula 4*

*2014 Transportation Route-Level Model Specification*

$$\ln Cost_j = \beta_0 + \sum_{i=1}^n \delta_i D_i \beta_1 + \ln\left(\frac{CFM_j}{CFM}\right) + \beta_2 \ln\left(\frac{CFM_j}{CFM}\right)^2 + \beta_3 \ln\left(\frac{RL_j}{RL}\right) + \beta_4 \ln\left(\frac{RL_j}{RL}\right)^2 + \beta_5 \ln\left(\frac{CFM_j}{CFM}\right) \ln\left(\frac{RL_j}{RL}\right) + \varepsilon_j$$

where, CFM equals cubic foot-miles, RL is route length, j equals each contract cost segment, the "bar" indicates a mean value, the "Di" are categorical variables, one for

each area, the “ $\epsilon$ ” are stochastic error terms, and the  $\beta$  and  $\delta$  coefficients are parameters to be estimated. 2014 Transportation Study at 12.

The model assumes that the independent variable in the model, cubic foot miles, and all route-length terms which interact, or are “crossed” with cubic foot miles are not correlated with the error term. It seems clear that cubic foot miles traversed by vehicles (i.e. capacity) is a function of cubic foot miles traversed by mail capacity (volume). This occurs because of the way mail capacity affects contracting for vehicle capacity, as described by the Postal Service’s Response to CHIR 3.<sup>41</sup>

The Commission and the Postal Service agree that the cost-to-volume relationship for purchased highway transportation can be analyzed as the product of two elasticities: the cost-to- capacity variability and the capacity-to-volume variability. The usefulness of this product is that the two capacity terms cancel each other out, as shown in formula 1. This is only possible, if there is no interaction between the terms used to estimate the two elasticities. The Postal Service asserts that material interactions are “unlikely” because they represent different steps in the purchased highway transportation network.<sup>42</sup> Nonetheless, the cost-to- capacity variability uses a measure of capacity that is itself influenced by the capacity-to-mail volume variability, a classic example of an endogeneity issue in econometrics.<sup>43</sup>

Specifically, changes in mail volume do not materially change vehicle capacity miles in the short run, because capacity is predominantly fixed by a contract. When a new contract is negotiated, or possibly renewed with some modifications, the Postal Service will estimate the amount of contract capacity it needs based on its evaluation of changes in the volume of mail transported recently. The period of time over which the

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<sup>41</sup> Responses Of The United States Postal Service To Questions 1-5 Of Chairman’s Information Request No. 3, (October 5, 2016), Response to Question 3i (“Response to CHIR3”).

<sup>42</sup> Responses of the United States Postal Service to Questions 1 - 9 Of Chairman’s Information Request No. 1, Response to Question 5.

<sup>43</sup> In econometrics, endogeneity is defined as a correlation between an independent variable and the error s in a regression analysis. In this transportation scenario, the independent variable in the capacity to volume equation, capacity, is correlated with the error term because capacity is not an exogenous variable. Rather, it changes in response to changes in volume, and is therefore an endogenous variable.

Postal Service observes changes in mail capacity which it uses to establish purchased vehicle capacity is unknown. The Public Representative does not know whether an economic forecast is made or whether managers review data and discuss likelihoods, but it does know that changes in mail capacity materially affect contracted vehicle capacity.

Thus, a large component of the error term is correlated with cubic foot miles traversed by vehicles (capacity) in Formula 4.<sup>44</sup> This means that all but 2 of the variability estimates from the 2014 Transportation Study are inconsistent and biased.<sup>45</sup> It is not possible to correct for this bias after the fact, unless one were to re-estimate the route-length models supplemented by models which capture the relation between volume and capacity using the same sample, the same definition of the capacity, estimating the relation between volume and capacity at the same level of aggregation for each cost-to-capacity variability estimate. For these reasons, multiplying the capacity-to-volume variabilities estimated in the proposed model by the cost to volume variabilities in the 2014 Transportation Study cannot correct the biased cost to capacity variability estimates caused by using endogenous explanatory variables.<sup>46</sup>

#### 4. Contracting Protocols Need Deeper Examination For Proper Modeling

New highway transportation contracts are negotiated approximately every four years terms. Each contract defines the routes and stops and vehicle capacity to be used for each route.<sup>47</sup> In spite of changes in frequency which may be made, it appears there

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<sup>44</sup> The correlation includes CFM and all of the Route-Length Terms which are “crossed” with CFM.

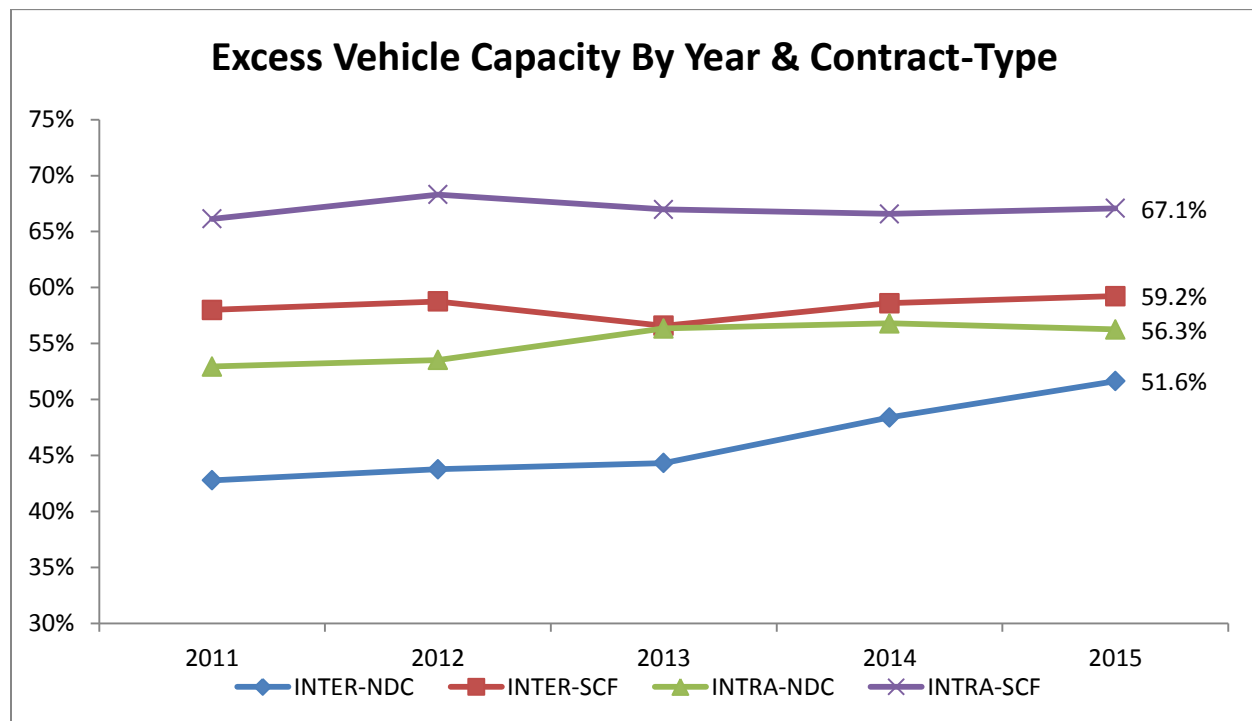
<sup>45</sup> An endogenous variable used in an ordinary least squares regression produces inconsistent estimates, which means they are biased in large samples, which is the case for this study.

<sup>46</sup> There are numerous endogenous variables: capacity, capacity-squared, and each interaction of capacity and capacity-squared with other variables, such as route length. There are numerous conditions which must be met in order to correct for endogeneity: the two models must use the same sample data, over identical time periods, the two models must perform regressions at the same level of disaggregation, the observations must utilize the same route or leg or other transportation level over time. In other words the sample must allow a panel analysis to be performed if the study is performed over more than one quarter. Absent meeting these conditions, it will be possible to solve for the effect of volume on capacity in the capacity to volume equations which will be applied to the capacity variable in the cost to capacity variable models.

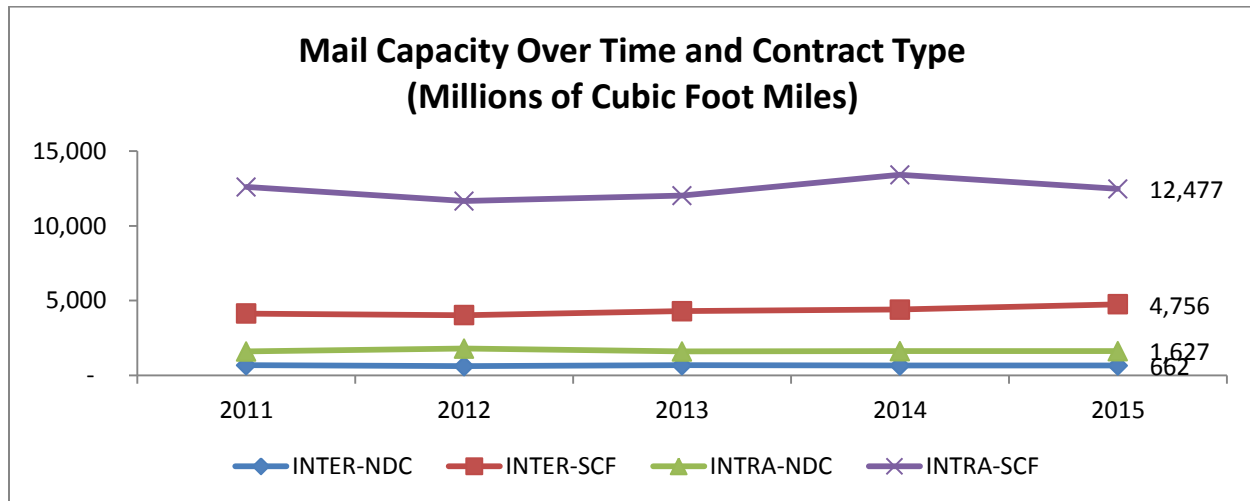
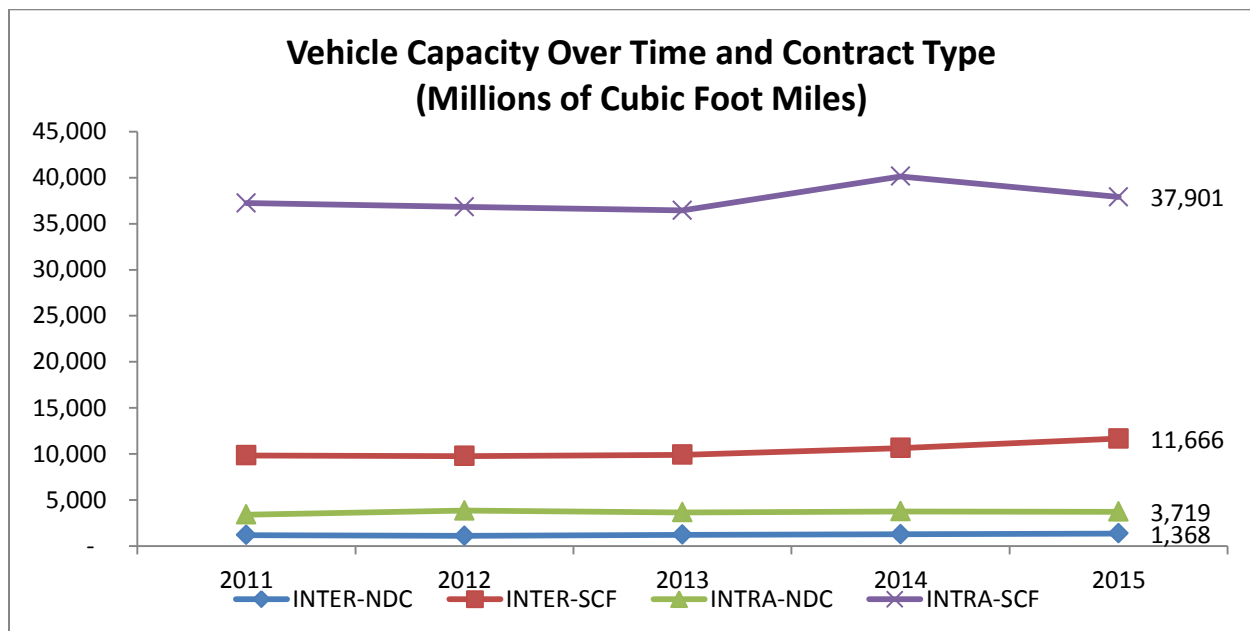
<sup>47</sup> See, Response to CHIR 3, Response to Question 2b.

is a capacity ceiling for each contract. It also appears as if there is a minimum or base amount of annual capacity to which the Postal Service commits to purchase in each contract. These observations mean that excess capacity will increase in periods of declining mail volume, and it will decrease in periods of growing mail volume. Chart 1 below shows that excess capacity by year has been fairly constant over the study period, with the exception of intra-SCF. This is because both the capacity of mail volume and vehicle size have remained stable over this period of time as shown in Charts 2 and 3.

**Chart 1<sup>48</sup>**



<sup>48</sup> USPS-RM2016-12/1, Public Material Relating to Proposal Four, Input.Data.Sets, submitted August 22, 2016.

**Chart 2<sup>49</sup>****Chart 3<sup>50</sup>**

<sup>49</sup> Source: USPS-RM2016-12/1, Public Material Relating to Proposal Four, Input.Data.Sets, submitted August 22, 2016

<sup>50</sup> Source: USPS-RM2016-12/1, Public Material Relating to Proposal Four, Input.Data.Sets, submitted August 22, 2016.

The charts reveal several important things. First, both mail capacity and vehicle capacity have been relatively constant during the study period. Also, vehicle capacity has remained a relatively constant multiple of mail capacity, approximately 2 times mail capacity for all but intra-SCF, which has a vehicle capacity approximately 3 times that of mail capacity. A closer look at Intra-SCF shows that the ratio of capacity to mail has been growing over time, even though mail volume is more or less constant. This accounts for the increased excess capacity in intra-SCF.

The Public Representative does not know how frequently contracts are renegotiated by contract-type, nor does it know the percentage of contracts which are renegotiated each year, but it appears as if the Postal Service has a “rule of thumb” to negotiate contracts so as to keep excess capacity roughly 60%. If true, it is not clear why such a high level of excess capacity is built into contracts<sup>51</sup>. . If the Postal Service is able to keep excess capacity relatively constant over time, it is also not clear why the variability of vehicle capacity to mail volume is not close to 100 percent. In any case, it is clear that the more information about the contracting process is needed in order to build transportation models of variability which are based on postal operations.

#### IV. RECOMMENDATIONS

The Public Representative recommends the Commission reject the proposed model and open an inquiry into the appropriate data, operational factors, and types of models which would produce unbiased long term variability estimates of overall transportation variability.<sup>52</sup> The Public Representative found several errors with the proposed model itself and provided the results from correcting those errors. However, the Public Representative believes that neither the proposed model, nor the model made with the corrections should be used to multiply against the cost to capacity

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<sup>51</sup> It may be the case that excess capacity is much less than at peak load, but it is unclear whether the Postal Service does not have the flexibility to adjust to known peak load periods, such as holiday seasons.

<sup>52</sup> The Public Representative refers to overall transportation variability, because endogeneity bias appears to rule out using the product of cost to capacity variability and capacity to volume variability. A recursive, or two-stage least squares model would only estimate the overall variability of transportation.

variabilities from the 2014 Transportation Study to establish overall transportation variabilities.

The Public Representative has shown that there are numerous inconsistencies between the 2014 and 2016 transportation study which are likely to result in biased overall transportation variabilities. Most importantly, the proposed model does not correct for the biased cost to capacity variabilities which have already been accepted, though it cannot be expected to, which explains why the Public Representative is recommending the Commission open an Inquiry, with the goal of adopting a reliable and unbiased, long-term model which estimates overall transportation variabilities.. Accepting the proposed model in conjunction with the current cost-to-capacity model would increase the bias associated with transportation variabilities, so it does not improve the accuracy of long-term transportation variability estimates, which is the Commission's goal for variability studies.<sup>53</sup> Therefore, the Public Representative recommends the Commission reject the propose model, but identifies areas where a model similar to the proposed model could be improved were a version of it to be considered in the informal rulemaking.

The Public Representative also makes the following recommendations towards development of more accurate long term highway transportation variability estimates:

- Existing data sources need to be supplemented, or new data sources must be found, from which both types of variabilities may be estimated. This is necessary to remove the inconsistencies the Public Representative has discussed in these Comments, especially the endogeneity problem.
- A model which effectively deals with the endogenous capacity variable should be employed. A recursive model, similar to one employed by

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<sup>53</sup> See, e.g., "We also adhere to our view expressed in Docket No. R77-1 that the relative magnitude of unforeseen events, including external events, over the long run will tend to display a degree of predictability, based upon historical results." PRC Op. Rec. R87-1, para. 2077 (Citations omitted.)," Docket No R2000-1, Op. Rec., Revised Volume 1, at 67, fn. 20.

Bradley, et. al. is a good candidate.<sup>54</sup> A two stage least squares model is another candidate.

- Mail shape should be incorporated into the variability models. Mail shape is an important cost driver in transportation. The Informal Inquiry should look to the carrier model for specification ideas.
- Finally, the apparent floor on excess capacity over the long term, as well as the restricted short term ability to modify capacity should be understood in full and if necessary, incorporated into the specification of the transportation models.

## V. CONCLUSION

The Public Representative respectfully submits the foregoing Comments for the Commission's consideration.

Respectfully submitted,

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<sup>54</sup> See, *Liberalization of the Postal and Delivery Sector*, Edward Elgar Publishing, 2006, "Measuring Scale and Scope Economies with a Structural Model of Postal Delivery, authors Bradley, M., Colvin, J., and Perkins, M.